CLAIMS

What is claimed is:

1. An assay method comprising:

providing a sample that is suspected of containing a target polynucleotide;

providing a polycationic multichromophore that electrostatically interacts with the target polynucleotide and upon excitation is capable of transferring energy to a signaling chromophore;

providing a sensor peptide nucleic acid (PNA) that is single-stranded and is complementary to the target polynucleotide, said sensor PNA conjugated to the signaling chromophore;

contacting the sample with the sensor PNA and the multichromophore in a solution under conditions in which the sensor PNA can hybridize to the target polynucleotide, if present;

applying a light source to the solution that can excite the multichromophore; and

detecting whether light is emitted from the signaling chromophore.

2. The method of claim 1, wherein the multichromophore comprises a structure selected from a saturated polymer, a conjugated polymer, a dendrimer, and a semiconductor nanocrystal.

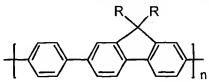
3. The method of claim 2, wherein the multichromophore comprises a saturated polymer.

4. The method of claim 2, wherein the multichromophore comprises a dendrimer.

5. The method of claim 2, wherein the multichromophore comprises a semiconductor nanocrystal.

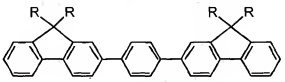
6. The method of claim 2, wherein the multichromophore comprises a conjugated polymer.

7. The method of claim 6, wherein the conjugated polymer has the structure



1 -R = -$(CH_2)_6NMe_3^{\oplus}\ I^{\ominus}$

8. The method of claim 6, wherein the conjugated polymer has the structure



2 -R = -$(CH_2)_6NMe_3^{\oplus}\ I^{\ominus}$

9. The method of claim 1, wherein the sample is contacted with approximately a 1:1 charge ratio of the sensor PNA and the multichromophore.

10. The method of claim 1, wherein the sample is contacted with the sensor PNA and the multichromophore in the presence of a sufficient amount of an organic solvent to decrease hydrophobic interactions between the sensor PNA and the multichromophore.

11. The method of claim 1, wherein the sample is contacted with a plurality of different sensor PNAs having corresponding different sequences, said different sensor PNAs comprising a corresponding different signaling chromophore, wherein each of said different sensor PNAs can selectively hybridize to a corresponding different target polynucleotide.

12. The method of claim 1, wherein the chromophore is a fluorophore.

13. The method of claim 12, wherein the fluorophore is selected from a semiconductor nanocrystal, a fluorescent dye, and a lanthanide chelate.

14. The method of claim 13, wherein the fluorophore is a semiconductor nanocrystal.

15. The method of claim 13, wherein the fluorophore is a fluorescent dye.

16. The method of claim 15, wherein the fluorescent dye is fluorescein.

17. The method of claim 13, wherein the fluorophore is a lanthanide chelate.

18. The method of claim 1, wherein the target polynucleotide is DNA.

19. The method of claim 1, wherein the target polynucleotide is RNA.

20. The method of claim 1, wherein the sample comprises single-stranded target polynucleotide.

21. The method of claim 1, wherein the sample comprises double-stranded target polynucleotide.

22. The method of claim 1, wherein the target polynucleotide is produced via an amplification reaction.

23. A polynucleotide sensing solution comprising:

a sensor peptide nucleic acid (PNA) that is single-stranded and is complementary to a target polynucleotide, said sensor PNA attached to a signaling chromophore;

a polycationic multichromophore that can electrostatically interact with the phosphate backbone of the target polynucleotide and is capable of transferring energy to

the signaling chromophore upon excitation when brought into proximity thereto upon hybridization of the sensor PNA to the target polynucleotide.

24. A kit for assaying a sample for a target polynucleotide comprising:

a sensor peptide nucleic acid (PNA) that is single-stranded and is complementary to the target polynucleotide, said sensor PNA conjugated to a signaling chromophore; and

a polycationic multichromophore that can electrostatically interact with the phosphate backbone of the target polynucleotide and is capable of transferring energy to the signaling chromophore upon excitation when brought into proximity thereto upon hybridization of the sensor PNA to the target polynucleotide.

25. The method of claim 1, wherein light emitted from the signaling chromophore above a threshold level indicates that the target polynucleotide is present in the sample.

26. The method of claim 1, wherein the amount of light emitted from the signaling chromophore is quantitated and used to determine the amount of the target polynucleotide in the sample.

27. The method of claim 12, wherein the fluorophore is a green fluorescent protein.

28. The method of claim 1, wherein the target polynucleotide is not amplified.

29. The method of claim 1, wherein the method is performed on a substrate.

30. The method of claim 29, wherein the substrate is conjugated to a plurality of different sensor PNAs.